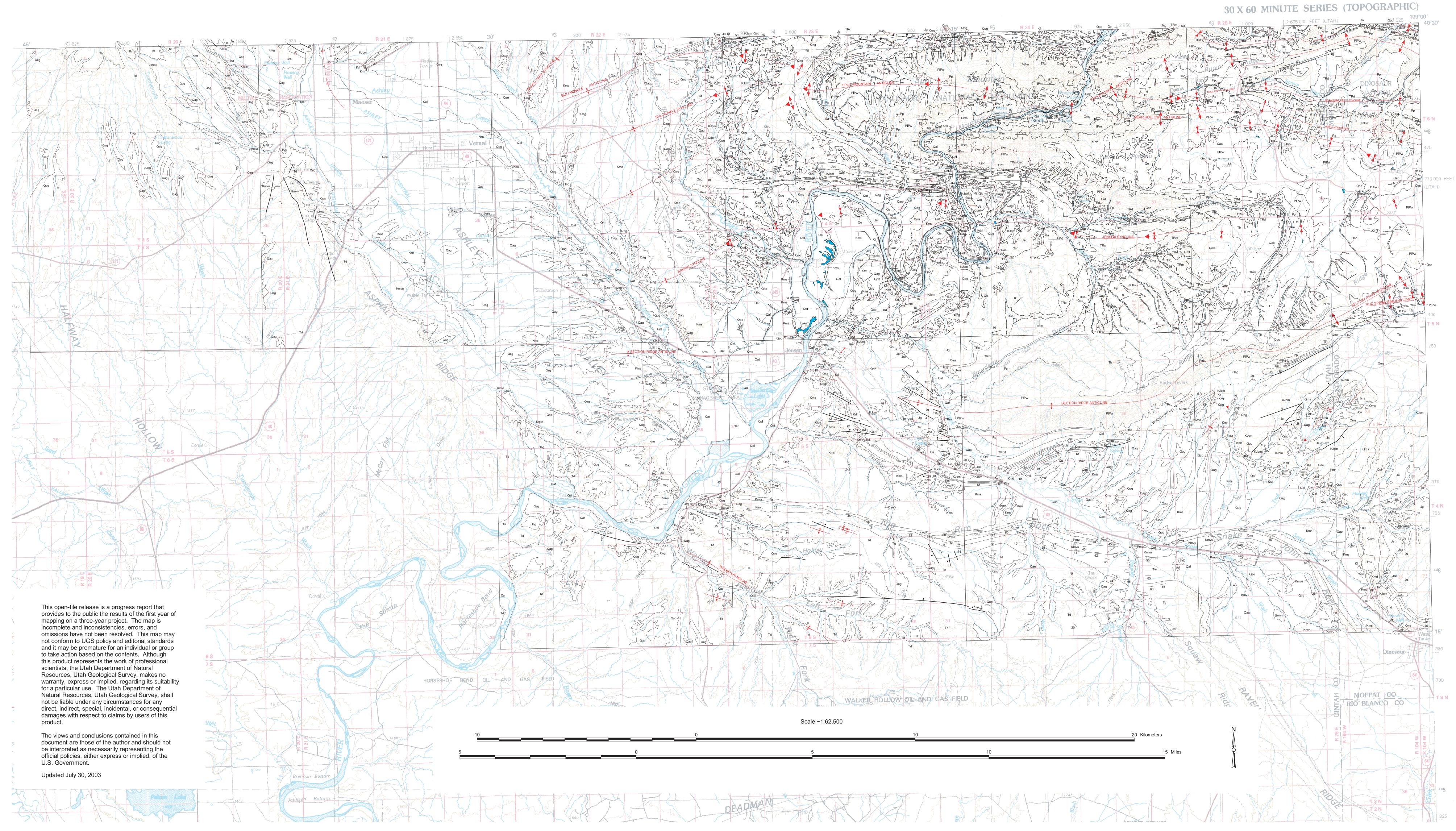
Utah Geological Survey Open-File Report 414 Progress Report Geologic Map of the Vernal 30' x 60' Quadrangle, Year 1 of 3

Compiled by Douglas A. Sprinkel

2003



Qaf

Qac

Qc\*

QTa\*

Year 1 of 3

# Description of Map Units

OD-PLAIN ALLUVIUM (HOLOCENE) - Unconsolidated silt, sand, and gravel in flood plains of Green River and Ashley and Brush Creeks; 1-30 m thick.	Tg	GREEN RIVER FORMATION (EOCENE) - Soft to moderately resistant, light- to medium-gray, light- to medium-brown, yellow, and greenish-gray mudstone
JVIUM (HOLOCENE) - Unconsolidated mud, silt, sand, and gravel in small intermittent stream drainages on the Yampa Plateau; less than 5 m thick.		organic-rich marlstone, siltstone, sandstone, and cherty limestor formation is divided into formal members, which includes the Mah ledge oil shale unit, but have not been mapped for the first year
RACE DEPOSITS (HOLOCENE) - Unconsolidated to locally cemented silt, sand, gravel, cobbles, and boulders; remnants of alluvial terraces deposited along the Green River and Ashley and Brush Creeks; less than a few tens of meters thick.		project; lower part intertongues with underlying Wasatch Formation and the upper part pinches out and is unconformably overlain by the Duchesne Formation near the Rim Rock; the formation intertongues with the overlying Uinta Formation near the White River drainage in the
NGER ALLUVIAL-FAN DEPOSITS (HOLOCENE) - Unconsolidated, poorly sorted boulder, gravel, sand, and silt; less than 30 m thick.		southeastern part of the quadrangle, which has yet to be mapped exposed thickness in the quadrangle is as much as 600 m thick, but is
ED ALLUVIUM AND COLLUVIUM (HOLOCENE) - Unconsolidated mud, silt, sand,		much thicker in the subsurface of the Uinta Basin.

- MIXED ALLUVIUM AND COLLUVIUM (HOLOCENE) Unconsolidated mud, silt, sand, and gravel in intermittent stream drainages and in areas of low topographic WASATCH FORMATION (EOCENE AND PALEOCENE[?]) - Red, yellow, and relief. On the Mancos Shale or other soft formations, this unit is mostly light-gray friable sandstone, siltstone, claystone, and conglomerate; reworked mud: less than 10 m thick upper part intertongues with overlying Green River Formation; conglomerate clasts consist of mostly gray limestone (Paleozoic), MIXED ALLUVIUM AND EOLIAN DEPOSITS (HOLOCENE) - Unconsolidated alluvial sandstone (Mesozoic), and some red quartzose sandstone and quartzite mud, silt, and sand mixed with well-sorted, fine-grained, windblown sand
- (Uinta Mountain Group); 610 m thick. and silt: many of these deposits are in tributary stream channels of the FORT UNION FORMATION (PALEOCENE) - Light-gray, light-brown, light-green, Green River, along smaller streams, and in other intermittent stream drainages. and brown sandstone, shale, and claystone with some carbonaceous EOLIAN DEPOSITS (HOLOCENE) - Unconsolidated, well-sorted, fine-grained, windblown shale, coal, siltstone, and conglomerate beds; beds of probable Fort
- sand and silt; less than 10 m thick. Union age are currently included in the base of the overlying Wasatch Formation; thickness not determined. COLLUVIUM (HOLOCENE) - Heterogeneous mixture of boulders, gravel, cobbles, sand and silt that may grade into talus, landslide, and alluvial deposits; thin UPPER UNIT OF MESAVERDE GROUP (UPPER CRETACEOUS) - Moderately to a few tens of meters thick. resistant, light-gray to pale-grayish-orange, fine-grained, lenticular
- DISTURBED GROUND (HISTORIC) Modern gravel pit operation mostly along the cross-bedded sandstone with carbonaceous shale and thick coal beds: 425-550 m thick. the flood plain of the Green River; material excavated is from unconcolidated deposits of Qal and Qaf; includes sewage lagoon along Ashley Creek. RIM ROCK FORMATION OF MESAVERDE GROUP (UPPER CRETACEOUS) -DEBRIS-FLOW DEPOSITS (HISTORIC) - Unconsolidated and poorly sorted heterogenous Resistant, light-gray, tan, and light-yellow, cross-bedded sandstone mixture of boulders, gravel, sand, silt, and mud; matrix supported; less than with subordinate gray carbonaceous shale and minor coal; local unit

TALUS DEPOSITS (HOLOCENE AND PLEISTOCENE?) - Unconsolidated and unstratified

SLIDES, SLUMPS AND FLOWS (HOLOCENE AND PLEISTOCENE) - Earthflow and

ALLUVIAL-GRAVEL DEPOSITS (HOLOCENE AND PLEISTOCENE) - Unconsolidated

OLDER ALLUVIAL-FAN DEPOSITS (PLEISTOCENE) - Dissected, unconsolidated,

GLACIAL OUTWASH, UNDIVIDED (UPPER PLEISTOCENE) - Unconsolidated, well-

OLDER ALLUVIUM (PLEISTOCENE AND UPPER TERTIARY[?]) - Unconsolidated,

adjoining Dutch John 30' x 60' quadrangle; less than 10 m thick.

BISHOP CONGLOMERATE (OLIGOCENE) - Light-gray to pinkish-gray, friable sandstone

DUCHESNE RIVER FORMATION (EOCENE) - Reddish-brown, yellowish-gray,

UINTA FORMATION (EOCENE) - "Soft," light-green-gray, light-brown, light-gray,

quadrangle (Sprinkel, 2002); less than 50 m thick.

the Uinta Basin.

1977); 0-600 m thick.

be a significant part of this deposit; less than 5 m thick.

common boundary with an adjoining mass movement.

origin; less than 2 m thick.

of the Vernal 30' x 60' quadrangle.

angular rock fragments that accumulate at the base of cliffs. Colluvium may

rotational slumps and slides in formations prone to slope failure; some Qms

to moderately consolidated, poorly sorted sand, gravel, cobbles and boulders

deposited on near-planar bedrock surfaces; as many as four levels are

recognized but are not subdivided for the first year of the project so deposits

of different ages can share a common boundary; the topographically highest level are oldest; weak to strong soil profile developed in all levels with the

best-developed profile in the topographically highest deposit; some calcium

carbonate (caliche; stage I) developed on the underside of clasts in younger

(lower) deposits and well-delveloped calcium carbonate (caliche; stage IV)

in upper 1 m of highest (oldest) deposit; all deposits may not be alluvial in

poorly sorted boulders, gravel, sand, and silt; less than 10 m thick. Mapped

in the Island Park 7.5-minute quadrangle (Rowley and others, 1981) within

the Dutch John 30' x 60' quadrangle, but may be preserved in nearby areas

rounded, mostly red quartzose sandstone and quartzite (Uinta Mountain

Group) boulders to pebbles and sand derived from the high-energy meltwaters

of glaciers of undetermined age that are preserved in the Whiterocks Canyon

drainage in the northwest part of the Vernal 30' x 60' quadrangle (see

Sprinkel, 2002); thickness not determined but probably less than 10 m thick.

poorly sorted, silt, sand, gravel, and cobble to boulder deposit; clasts are

subangular to subrounded Uinta Mountain Group, mostly matrix supported

with internal channel deposits; these deposits are best exposed but not

yet mapped on the Yampa Plateau in this quadrangle and mapped as

Oaco (Sprinkel 2002) on the nearby Diamond Mountain Plateau in the

with tuffaceous interbeds, and poorly sorted, loosely cemented, boulder to

crystals from a tuff bed yielded K-Ar ages of about 29 Ma (Hansen, 1986)

on nearby Diamond Mountain Plateau in the adjoining Dutch John 30' x 60'

and greenish-gray lithic sandstone, siltstone, claystone, and conglomerate;

contains well-developed paleosols: formation has been divided into four

members--in ascending order, Brenan Basin, Dry Gulch, LaPoint, and

been mapped for the first year of the project: the lower part of formation

intertongues with underlying Uinta Formation to the south in the Uinta

Basin; 270 m in quadrangle, but more than 1,000 m thick southward in

and pale-vellow shale, marlstone, siltstone, and sandstone with locally

tuffaceous interbeds; divided into informal members, which have not

been mapped for the first year of this project; contains significant gilsonite

deposits in the southeastern part of the quadrangle and around Bonanza,

Utah; a tuff bed in the formation yielded K-Ar age of 43 Ma (Mauger,

Starr Flat Members (Anderson and Picard, 1972)--but they have not

pebble conglomerate mapped on the Yampa Plateau; biotite and hornblende

units may include mass movements of slightly different age or may share a

- defined by Walton (1944); 200-250 m thick. MANCOS SHALE (UPPER CRETACEOUS) - Dark-gray, soft, slope-forming calcareous shale containing beds of siltstone and bentonitic clay;
  - 1,500-4,900 m thick. FRONTIER SANDSTONE, MOWRY SHALE AND DAKOTA SANDSTONE, UNDIVIDED - These formations are shown as one unit along part of the south flank of the Yampa Plateau; see below for descriptions and
- FRONTIER SANDSTONE (UPPER CRETACEOUS) Upper part resistant, lightbrown to light-gray and yellow, fine-grained and ripple-marked sandstone with local petrified wood and fossils; lower part soft, light- to dark-gray calcareous shale; may include minor limestone and coal beds in the lower part; 52-83 m thick.
- MOWRY SHALE AND DAKOTA SANDSTONE, UNDIVIDED These formations are locally shown as one unit along Snake John Reef because they were too thin to map separately at this scale. See below for descriptions
- MOWRY SHALE (LOWER CRETACEOUS) Dark-gray, siliceous shale that weathers silver gray; contains abundant fossil fish scales; 10-67 m
- DAKOTA SANDSTONE (LOWER CRETACEOUS) Upper and lower resistant, yellow and light-gray, medium- to coarse-grained sandstone beds separated by a carbonaceous shale; contains coal beds in exposures along the flank of Split Mountain (Doelling and Graham, 1972); 15-76
- CEDAR MOUNTAIN FORMATION AND MORRISON FORMATION Cedar Mountain is mapped with the underlying Morrision Formation because it is generally thin and the contact with the underlying Morrison is difficult to determine; total thickness of map unit is 244-347 m.
  - Cedar Mountain Formation (Lower Cretaceous) Purple, gray, and greenishgray mudstone, siltstone, minor sandstone and limestone; contains calcrete beds that weather out as carbonate nodules; 0-60 m thick. Morrison Formation (Upper Jurassic) - Upper Brushy Basin Member consists of soft, banded, variegated (light-gray, olive-gray, red, and light-purple) shale, claystone, siltstone, and minor cross-bedded sandstone, conglomerate, and bentonite; lower Salt Wash Member consists of resistant, light-gray to white cross-bedded sandstone; dinosaur remains are preserved in the Salt Wash Member at Dinosaur National Monument;
- Morrison is 244-287 m thick STUMP FORMATION, ENTRADA SANDSTONE, AND CARMEL FORMATION, UNDIVIDED - These formation are mapped as one unit where too thin to show separately at this scale; see below for unit description and
  - STUMP FORMATION (UPPER AND MIDDLE JURASSIC) Upper Redwater Member is greenish-gray and light-green slope-forming shale with glauconitic, fossiliferous (belemnites) sandstone and limestone. Lower Curtis Member is resistant, light-gray to greenish-gray, cross-bedded, fossiliferous, glauconitic sandstone, oolitic limestone, and fissile shale;
- total thickness is 40-80 m. ENTRADA SANDSTONE (MIDDLE JURASSIC) - Upper reddish-brown siltstone and fine-grained sandstone and a lower light-gray, pink, and lightbrown sandstone; lower sandstone is resistant to erosion and forms cliffs and ridges; 12-75 m thick.
- CARMEL FORMATION (MIDDLE JURASSIC) Medium- to dark-red, green, and gray sandy shale, sandstone, siltstone, limestone and gypsum; upper part is mostly slope-forming red shale, siltstone, and sandstone underlain by a middle gypsiferous unit: lower part is mostly red siltstone and thin ledge-forming limestone, which is commonly oolitic and fossiliferous;

part of the underlying Chinle Formation; 180-310 m thick.

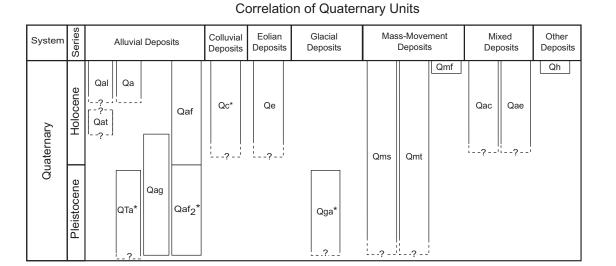
GLEN CANYON SANDSTONE (LOWER JURASSIC) - Pink, light-gray, and lightbrown, resistant, large-scale cross-bedded sandstone; forms cliffs and ridges; top 2-10 m of the formation may include beds of the Middle Jurassic Page Sandstone. Dinosuar tracks of Late Triassic age are reportedly preserved in strata 7 m above the base of the Glen Canvon Sandstone in the Red Fleet area of the adjoining Dutch John 30' x 60' quadrangle (Lockley and others, 1992), but these beds may really be

- CHINLE, MOENKOPI, AND DINWOODY FORMATIONS, UNDIVIDED Combined **T**icd as one map unit where formations are too thin to map at this scale; see below for descriptions and thickness.
- CHINLE FORMATION (UPPER TRIASSIC) Purplish-red, purple, light-gray, greenish-gray, light-green, ripple-marked siltstone, sandstone, claystone shale, and conglomerate; generally forms slopes; base is resistant conglomerate unit named the Gartra Member; 83-121 m thick.
  - MOENKOPI AND DINWOODY FORMATIONS, UNDIVIDED Combined as one map unit where formations are too thin to map at this scale; see below for descriptions and thickness.
- MOENKOPI FORMATION (LOWER TRIASSIC) Medium- to dark-red, reddishbrown, green, and gray, ripple-marked siltstone, fine-grained sandstone. and shale with gypsum and limestone beds; mostly soft, slope-forming
- DINWOODY FORMATION (LOWER TRIASSIC) Light-gray, greenish-gray, lightbrown, and brown, thin-bedded, ripple-marked shale, siltstone, and sandstone with minor amounts of limestone. "Soft," slope-forming unit
- along the flanks of the Yampa Plateau; 0-162 m thick. PARK CITY AND PHOSPHORIA FORMATIONS (LOWER PERMIAN) - Combined thickness of Park City and Phosphoria Formations is 20-122 m. Franson Member of Park City Formation - Gray, thick- to thin-bedded cherty limestone and dolomite interbedded with brownish-gray sandstone and
  - red to ochre shale; generally resistant and forms ledges and cliffs. Meade Peak Phosphatic Shale Member of the Phosphoria Formation - Slopeforming, dark-gray phosphatic shale with interbeds of sandstone and
  - Grandeur Member of Park City Formation Light-gray to light-brownish-gray sandstone, dolomite, and limestone; generally resistant and forms ledges and cliffs. WEBER SANDSTONE (LOWER PERMIAN TO MIDDLE PENNSYLVANIAN) -
- Light-gray to yellowish-gray, very thick bedded sandstone with interbeds of limestone in the lower part; highly cross-bedded sandstone in the upper part; forms steep cliffs and ridges; 230-472 m thick. MORGAN FORMATION (MIDDLE PENNSYLVANIAN) - Light- to medium-red,
- yellow, and gray shale and siltstone, light- to medium-gray fossiliferous and red cherty limestone, and light-red-gray, fine-grained, locally crossbedded sandstone; 11-290 m thick.
- ROUND VALLEY LIMESTONE (LOWER PENNSYLVANIAN) Light-gray to lightblue-gray, thin- to very thick bedded limestone interbedded with soft red shale; limestone is fossiliferous and cherty; chert is blue gray and yellowish gray, but red to pink jasperoid chert is common in the region; forms ledges and cliffs; only exposed in Split Mountain; 65-127 m
- DOUGHNUT SHALE AND HUMBUG FORMATION (UPPER MISSISSIPPIAN) -Thickness of map units is 160-181 m; only exposed in Split Mountain. Doughnut Shale - Dark-gray shale, with some red shale near base, with beds of coarse sandstone, limestone and coal; shale is slope forming and clayey; only exposed in Split Mountain; 85-91 m thick.
  - Humbug Formation Light-gray to red, fine-grained to very fine grained, "soft" to resistant sandstone interbedded with light-gray limestone and red to black shale: sandstone is locally cross-bedded and hematitic near top of formation; 75-90 m thick. MADISON LIMESTONE (UPPER AND LOWER MISSISSIPPIAN) - Mostly dark-
- gray, medium to coarse crystalline, cherty limestone; chert is typically light gray; regionally contains numerous caves and sinkholes; only exposed in Split Mountain; 130-300 m thick.

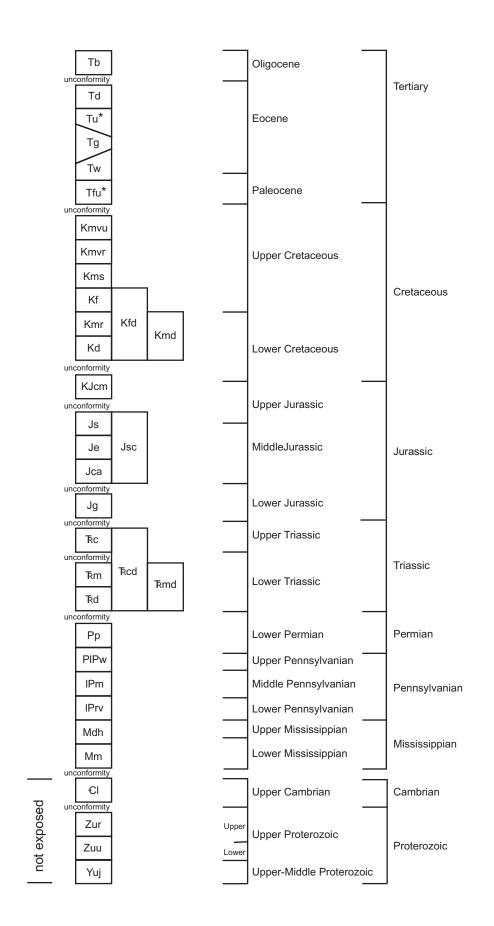
### NOT EXPOSED IN VERNAL 30' X 60' QUADRANGLE LODORE FORMATION (UPPER CAMBRIAN) - Light-brown to greenish-gray

- sandstone underlain by pink to tan to pale-greenish-gray glauconitic shale interbedded with tan to pale-green sandstone; base is variegated (pink, gray, and pale-green) coarse- to medium-grained cross-bedded sandstone; locally pebbly; upper part forms ledges, middle part forms slopes and ledges, and lower part forms cliffs; Lodore pinches out to the west: 0-180 m thick.
- RED PINE SHALE OF THE UINTA MOUNTAIN GROUP (MIDDLE PART OF UPPER PROTEROZOIC) - Dark-gray to dark green-gray shale and siltstone; interbedded with brown-gray to brown-red sandstone and quartzite, thin bedded near base becoming thick bedded near the top; sandstone is medium- to coarse-grained, cross-bedded, and siliceous; age is based on playnomorphs recovered from base of formation in the southwest part of the Dutch John 30' x 60' quadrangle (Sprinkel, 2002; Sprinkel and others, 2002); estimated at 0-550 m thick.
- UNNAMED FORMATION OF THE UINTA MOUNTAIN GROUP (MIDDLE AND LOWER PART OF UPPER PROTEROZOIC) - Dark- to light-red, fineto coarse-grained, quartzose and lithic sandstone and quartzite, sandstone is thick- to medium-bedded; planar-, cross-, and contorted-bedding is preserved; some beds contain tool and groove marks, ripples, and mudcracks; contains considerable red, green, and dark-gray micaceous shale interbeds and some conglomerate; age is based on palynomorphs recovered from near middle of formation in the Dutch John 30' x 60' quadrangle (Sprinkel, 2002; Sprinkel and others, 2002); as much as 3,500 m thick.
- JESSE EWING CANYON FORMATION OF THE UINTA MOUNTAIN GROUP (MIDDLE PROTEROZOIC) - Dark- to light-red, brown, and reddishpurple pebble to boulder conglomerate interbedded with quartzose and lithic sandstone and shale; clasts are white, pale green, and pink quartzite (from Red Creek Quartzite), subrounded to subangular; thickto medium-bedded and fining up in individual beds as well as the formation as a whole; age is based on palynomorphs (Sprinkel and others, 2002) preserved in a down-faulted block defined as basal Jesse Ewing Canyon Formation by Sanderson and Wiley (1986) but mapped as the overlying unnamed formation for the Dutch John 30' x 60' quadrangle (Sprinkel, 2002); 225 m thick.

\* Exposed in the Vernal 30' x 60' quadrangle, but not in area mapped for the first year of the project



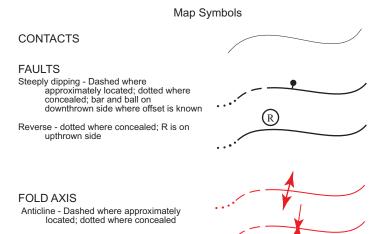
### Correlation of Bedrock Units



- Anderson, D.W., and Picard, M.D., 1972, Stratigraphy of the Duchesne River Formation (Eocene-Oligocene?), northern Uinta Basin, northeastern Utah: Utah Geological and Mineral Survey Bulletin 97, 29 p. Doelling, H.H., and Graham, R.I., 1972, Eastern and northern coal fields: Utah Geological and Mineral Survey Monograph 2, 411 p.
- Hansen, W.R.. 1986, Neogene tectonics and geomorphology of the eastern Uinta Mountains in Utah, Colorado, and Wyoming: U.S. Geological Survey Professional Paper 1356, 78 Lockley, M.G., Conrad, Kelly, Paquette, Marc, and Hamblin, A.H., 1992, Late Triassic
- vertebrate tracks in the Dinosaur National Monument area in Wilson, J.R, editor, Field guide to geologic excursions in Utah and adjacent areas of Nevada, Idaho, and Wyoming: Utah Geological Survey Miscellaneous Publication 92-3, p. 383-391. Mauger, R.L., 1977, K-Ar ages of biotite from tuffs in Eocene rocks of the Green River, Washakie, and Uinta Basins, Utah, Wyoming, and Colorado: University of Wyoming
- Sanderson, I.D., and Wiley, M.T., 1986, The Jesse Ewing Canyon Formation, an interpreted alluvial fan deposit in the basal Uinta Mountain Group (Middle Proterozoic): The Mountain Geologist, v. 23, no. 3, p. 77-89.

Contributions to Geology, v. 15, p. 17-41.

- Sprinkel, D.A., 2002, Progress report geologic map of the Dutch John 30' x 60' quadrangle, Utah-Colorado-Wyoming: Utah Geological Survey Open-File Report 399, 3 plates,
- Sprinkel, D.A., Waanders, G.R., and Robbins, E.I., 2002, Stratigraphy, palynology, and maturity of the Proterozoic Uinta Mountain Group, eastern Uinta Mountains, Utahimplications for unit thickness: Geological Society of America Abstracts with
- Programs, v. 33, no. 4, p. A-18 Walton, P.T., 1944, Geology of the Cretaceous of the Uinta Basin, Utah: Geological Society of America Bulletin, v. 55, p. 91-130.

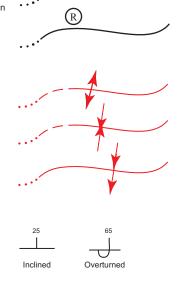


STRIKE AND DIP OF BEDDING

Monocline - dotted where concealed

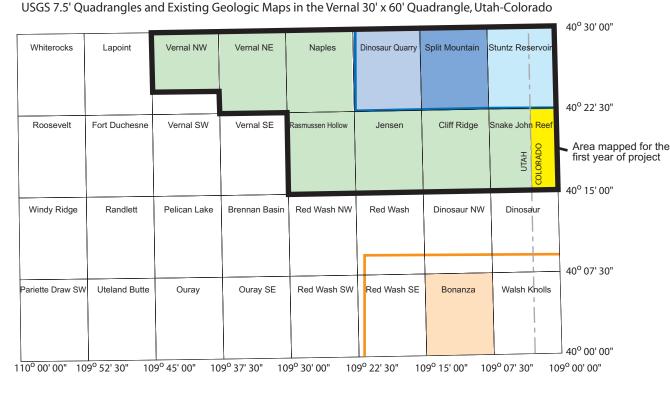
Syncline - Dashed where approximately

located; dotted where concealed



## Stratigraphic Column

SYSTEM	SYMBOL		FORMATIONS	Thickness (meters)	LITHOLOGY	NOTES
Quat.	Q**		Unconsolidated deposits	less than 50		Alpine glaciers in Uinta Mountains. Capture of Green River by Colorado River
Tertiary	QTa		Older alluvium	less than 10		Crustal relaxation; Uinta Mountains down dropped along Uinta fault zone and drainage patterns change in eastern Uintas.
	Tb		Bishop Conglomerate	less than 50	**************************************	
	Td		Duchesne River Formation	1,000		Crustal stability; Gilbert Peak erosion surface forms and Bishop Conglomerate is deposited
	Tu		Uinta Formation	0-600		Contains gilsonite deposits
	Tg		Green River Formation	600+		Uinta Mountains continue to uplift, erosion exposed Uinta Mountain Group, and creation of Lake Uinta as the Uinta Basin continues to subside; contains oil shale and oil reserves
	Tw		Wasatch Formation	610		Uinta Mountains continue to uplift, erosion exposed Uinta Mountain Group, and subsidence of Uinta Basin; gas reservoir in Uinta Basin
	Tfu		Fort Union Formation	not determined		Unconformity, 6 m.y.; TK boundary and the extinction of dinosaurs
	Kmvu	Mesaverde	Upper unit	425-550		Uplift of Uinta Mountain begins near end of Cretaceous
	Kmvr	Mes	Rim Rock Formation	200-250		Strata thins to east
Cretaceous	Kms		Mancos Shale	1,500-4,900		End of great Western Interior Seaway
O	Kı	F	Frontier Sandstone	52-83		Gas reservoir in Uinta Basin
	₩ Kn		Mowry Shale	10-67		Unconformity, 5 m.y. Fossil fish scales in Mowry
	K	_	Dakota Sandstone	15-76		Gas reservoir in Uinta Basin
	14.1		Cedar Mountain Formation	0-60		K-1 unconformity, 2 m.y. K-0 unconformity, 25 m.y.
	KJcm		Morrison Formation	244-287		Abundant dinosaur remains  J-5 unconformity, 2 m.y.
Jurassic	၂s	_	Stump Formation	40-80		Belemnites fossils
IIas	S Je		Entrada Sandstone	12-75		J-3 unconformity, 1 m.y.
⊣	Jca	1	Carmel Formation	30-118		Isocrinus fossils
	Jg		Glen Canyon Sandstone	180-310	_(:::::::::	J-2 unconformity, 14 m.y.; top of Jg may include Page Sandstone  - J-0 unconformity, 7 m.y.
Sic.	o Ro		Chinle Formation	83-121	T.T.T.T.T.T.	Ankareh and Stanaker Fm. of some workers Gartra Member
Triassic	Tan	n	Moenkopi Formation	170-260		Tr-3 unconformity, 15 m.y.
	Ŧ	t	Dinwoody Formation	0-162	<u> </u>	- Tr-1 unconformity, 6 m.y.
an	Pp	P	ark City and Phosphoria Formations	20-122		Phosphate deposits
Permian	PIPw		Weber Sandstone	230-472	· · · · · · · · · ·   -	Unconformity, 3 m.y.  Forms cliffs and important oil reservoir in the Rocky Mountains
nn.	ID		Managa Farmatian	44.000	<u> </u>	,
Penn.	IPm IPrv		Morgan Formation Round Valley Limestone	11-290 65-127	<del></del>	
	Mdh		Doughnut Shale	85-91		
Miss.			Humbug Formation	75-90		
	Mm		Madison Limestone	130-300		Forms cliffs, contains marine fossils Unconformity, about 220-350 m.y.
Cam.	€I		Lodore Formation	0-180		
	Zur	Group	Red Pine Shale	~0-550	drangle	
Proterozoic	Zuu	Uinta Mountain Gro	Unnamed Formation	as much as 3,500	not exposed in the quadrangle	Forms the core of Uinta Mountains; Flaming Gorge Dam constructed in this unit
	Yuj	jā	Jesse Ewing Canyon Formation	225	**************************************	
**See	Corre	lation	of Quaternary Units for symbols			



## Source of Map Data

- Cashion, W.B., 1986, Geologic map of the Bonanza quadrangle, Uintah County, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1865, scale 1:24,000. Cashion, W.B., and Brown, J.H., Jr., 1956, Geology of the Bonanza-Dragon oil shale area, Uintah County, Utah, and Rio Blanco County, Colorado: U.S. Geological Survey Oil and Gas Investigations Map OM-153, scale 1:62,500. Doelling, H.H, and Graham, R.L., 1972, Coal and geology map, Cliff Ridge quadrangle, in Doelling, H.H., and Graham, R.L., Eastern and northern Utah coal fields: Utah
- Geological and Mineral Survey Monograph Series 2, p. 32-33, scale 1:42,240; and Sprinkel, D.A, unpublished mapping, scale 1:24,000. ----1972, Coal and geology map, Dry Fork-Vernal NW quadrangle, in Doelling, H.H., and Graham, R.L., Eastern and northern Utah coal fields: Utah Geological and Mineral Survey Monograph Series 2, p. 48-49, scale 1:42,240; and Sprinkel, D.A., unpublished mapping; scale 1:24,000.
- ----1972, Coal and geology map, Rasmussen Hollow quadrangle, in Doelling, H.H., and Graham, R.L., Eastern and northern Utah coal fields: Utah Geological and Mineral Survey Monograph Series 2, p. 78-79, scale 1:42,240; and Sprinkel, D.A., unpublished mapping; scale 1:24,000. ----1972, Coal and geology map, Snake John Reef quadrangle, in Doelling, H.H., and Graham, R.L., Eastern and northern Utah coal fields: Utah Geological and Mineral
- Survey Monograph Series 2, p. 82-83, scale 1:42,240; and Sprinkel, D.A., unpublished mapping; scale 1:24,000. ----1972, Coal and geology map, Steinaker Reservoir-Vernal NE quadrangle, in Doelling, H.H., and Graham, R.L., Eastern and northern Utah coal fields: Utah Geological and Mineral Survey Monograph Series 2, p. 86-87, scale 1:42,240; and Sprinkel, D.A.,
- unpublished mapping; scale 1:24,000. ----1972, Coal and geology map, Vernal NE-Vernal SE quadrangle, in Doelling, H.H., and Graham, R.L., Eastern and northern Utah coal fields: Utah Geological and Mineral Survey Monograph Series 2, p. 32-33, scale 1:42,240; and Sprinkel, D.A., unpublished mapping; scale 1:24,000.
- Hansen, W.R., and Rowley, P.D., 1980, Geologic map of the Stuntz Reservoir quadrangle, Utah-Colorado: U.S. Geological Survey Geologic Quadrangle Series Map GQ-1530,
- Hansen, W.R., Rowley, P.D., and Carrara, P.E., 1983, Geologic map of Dinosaur National Monument and vicinity, Utah-Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I-1407, scale 1:50,000. Rowley, P.D., and Hansen, W.R., 1979, Geologic map of the Split Mountain quadrangle,
- Uintah County, Utah: U.S. Geological Survey Geologic Quadrangle Series Map GQ-1515, scale 1:24,000. Rowley, P.D., Kinney, D.M., and Hansen, W.R., 1979, Geologic map of the Dinosaur Quarry quadrangle, Uintah County, Utah: U.S. Geological Survey Geologic Quadrangle Series Map GO-1513, scale 1:24,000.
- Sprinkel, D.A., 2003, unpublished mapping of the eastern part of the Snake John Reef quadrangle, Moffat County, Colorado, scale 1:24,000.

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